Exam2

ⓘ This is a preview of the published version of the quiz

Started: Dec 9 at 7:34pm

Quiz Instructions

This exam is open book, open notes, you may use any online/hardback textbooks you like. You may use calculators and matlab, but may not collaborate with other people. All multiple choice and fill-in-the-blank answers should be within 5% of correct value.

Unless stated otherwise in the question, use 2 decimal precision in fill-in-the blank questions, such as "132.31" or "58.02" for example. Also, canvas might force you to enter a leading "0" for numbers less than one, such as "0.11" and entries such as ".11" might be disallowed.

As always, make sure that you are in a location with good internet connectivity during the exam. It is not a bad idea to practice tethering through your cellphone as a backup to your regular internet access. Make sure your browser is compatible with canvas.

I may monitor my email tpweldon@uncc.edu (mailto:tpweldon@uncc.edu) during the exam, in case of some major urgent issue during the exam. Because the exam is online, most issues will have to wait until after the exam is completed, so do not expect any reply to any email, and **proceed on** with the exam even if you send an email.

Question 1 5 pts

A sound pressure level of 0.07 Pa rms, would correspond to a level L_p in dB_{SPL} units of

Question 2 5 pts

Increasing the tension of a string by a multiplicative factor of 4 increases the fundamental frequency by a multiplicative factor of

Question 3 5 pts

Compared to a single acoustic source, the amplitude of the pressure p on boresight for an a 5-element array increases by a multiplicative factor of

Question 4 5 pts

The maximum signal to noise ratio in dB for an ADC with 14-bit resolution is

Question 5 5 pts

If a musical note is at 203 Hz, then the frequency in Hz of a note 6 semitones higher is

Question 6 5 pts

If a sound intensity of 63 dB_{SIL} is observed in the far field of a monopole at a distance of 5 meters from the source, increasing the distance to 83 meters would result in a sound level in dB_{SIL} of

Question 7 5 pts

In a system with a sample rate of 5,000 samples/second, the continuous-time frequency f=200 Hz corresponds to a discrete-time frequency in rad/sample (to 3 decimal places) of ω=

Question 8 5 pts

Assume an analog-to-digital converter at 3,000 samples/second outputs the digitized 4-point sequence $x[n]$, and has a corresponding DFT $X[k]$={1, 2, 3, 2}. In the DFT, the index k=1 corresponds to a continuous time frequency in rad/s of Ω =

Question 9 5 pts

Find the reflection coefficient Γ_L of a Z_L=635 N s/m^3 load driven by an acoustic transmission line with length 7 m, Z_0=254 N s/m^3, and phase velocity vp=2 m/s at a frequency of 1200 Hz. The reflection coefficient (to 3 decimal places) is Γ_L =

Question 10 5 pts

The SWR observed an acoustic transmission line with length 6 m, Z_0=2 N s/m^3, and phase velocity vp=6 m/s is SWR=5. The magnitude of the reflection coefficient (to 3 decimal places) is $|\Gamma_L|$=

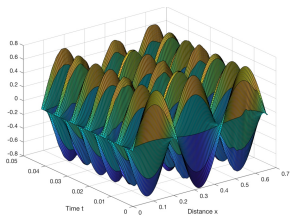
Question 11 5 pts

The SWR of an acoustic transmission line terminated by a load with Γ=0.6+j0.3 is SWR=

Question 12 5 pts

A 8 m long cable is attached to walls at both ends and has a linear mass density ρ_R=0.1 kg/m and tension 81 N, the the frequency of the n=5 mode in Hz (to 3 decimal places) is f=

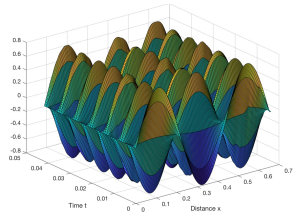
Question 13 5 pts



The figure above shows the velocity profile of a transverse standing wave on a string attached to walls at x=0 m and x=0.7 m. The mode of the standing wave is n=

- 1
- 3
- 2
- none above
- 4

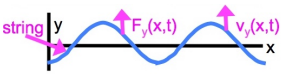
Question 14 5 pts



The figure above shows the velocity profile of a transverse standing wave on a string attached to walls at x=0 m and x=0.7 m. The frequency of the mode in Hz most nearly equals f=

- 0.3
- .01
- none above
- 120
- 10

Question 15 **20 pts**



Assume the string transmission line above with the following properties:

linear mass density ρ_R =0.2 kg/m

string tension Ts of T_S= 125 N

signal frequency f=10 Hz

NOTE: you must use dropdown menus below to answer **all parts** of this question.

Part 1: The phase velocity of the wave in m/s is v_p=

[Select]

Part 2: The wavelength in meters of the wave is λ=

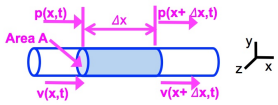
[Select]

Part 3: The wavenumber, or spatial frequency, of the mechanical wave in rad/m is

β= [Select]

Part 4: The characteristic impedance of the mechanical transmission line in N/(m/s) is Z_0= [Select]

Question 16 **15 pts**



Assume the acoustic transmission line above is filled with a fluid and has the following properties:

cross-sectional area A=0.001 m^2

mass density ρ_R =4 kg/m^3

compressibility κ_R=10^{-8} Pa^{-1}

acoustic signal frequency f=100 Hz

NOTE: you must use dropdown menus below to answer **all parts** of this question.

Part 1: The phase velocity of the acoustic wave in the fluid in m/s is v_p=

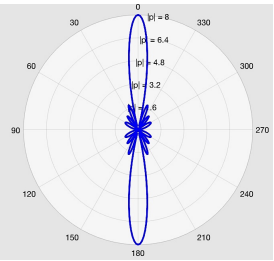
[Select]

Part 2: The wavelength in meters of the acoustic wave in the fluid is λ=

[Select]

Part 3: The characteristic impedance of the acoustic transmission line in N s/m^3 is Z_0= [Select]

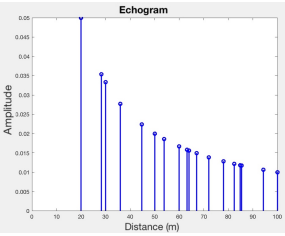
Question 17 5 pts



Assuming half-wave spacing between monopoles, the number N of equally-spaced monopoles that were used to create the array pattern shown above are N=

- 8
- 4
- none above
- 6

Question 18 5 pts



The echogram above was generated using a single acoustic monopole source in a room with a single microphone. The distance in meters between the microphone and source is

- 28
- 30
- 36
- 20
- none above

Question 19 5 pts

$v_z(x,t) = 5e^{j\omega\sqrt{\rho\kappa}x}e^{j\omega t}$ describes a wave propagating in the positive-z direction.

- True
- False

Question 20 5 pts

What is the first-null beamwidth FNBW in degrees of an acoustic array in air with 342 m/s phase velocity, at a frequency of 1 kHz, with 7 speakers having 0.3 meter spacing between adjacent speakers. FNBW in degrees=

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